BOOK REVIEWS

NUMERICAL METHODS FOR SHALLOW WATER FLOW by C. B. Vreugdenhill, Water Science and Technology Library, Volume 13, Kluwer Academic Publishers, Dordrecht, 1994. No. of pages: 261. Price: £78.00. ISBN 0-7923-3164-8.

Fluvial geomorphologists made some use of one-dimensional models of flood routing and sediment transport during the 1960s and 1970s. The 1980s saw the advent of distributed approaches to modelling in areas such as hillslope hydrology, but it is only now that fluvial geomorphologists are beginning to recognize the benefits of two- and three-dimensional treatments of river channel flow and sediment transport problems, with an increasing use of computational fluid dynamics (CFD) packages. Such packages have been developed largely by civil engineers, and as a precursor to effective use, it is critical that geomorphologists familiarize themselves with the assumptions, and therefore the limitations, behind the models that they are using. Without such knowledge, their ability to use such methods will continually be questioned, and the application of these models to natural channels will escape the domain of the geomorphologist, becoming firmly entrenched in the civil engineering community. As a PhD student in a Geography Department, but making extensive use of numerical models of shallow-water flow, I realized how difficult it was to get that knowledge. It was virtually impossible to find a text that was accessible and which dealt explicitly with the special type of boundary layer flows in which I was interested. I was therefore forced to synthesize material from a large number of different texts, an activity that took considerable time.

This book would have made the job much easier. It is a succinctly written volume aimed at engineers, developers of CFD code, and mathematicians who require insight into the problems for which they are developing solutions. The emphasis is on engineering applications in rivers, estuaries and coastal seas – areas that have traditionally been the domain of the geomorphologist. Although the author claims to assume a basic knowledge of fluid mechanics and CFD, any fluvial geomorphologist with a reasonably mathematical ability and a willingness to persevere should find the text accessible. The book begins with a general introduction to the types of shallow-water flows which are commonly encountered. Chapter 2 provides the basic theories on which the shallow-water flow equations are based, and this should be basic minimum reading for anyone using CFD software in geomorphology. Chapter 5 (dealing with boundary conditions), Chapter 6 (dealing with spatial discretization) and Chapter 8 (dealing ith model solution) are also particularly useful. The remaining chapters focus more on the properties and behaviour of the equations, and are likely to be of less relevance to the geomorphologist. For those geomorphologists about to jump into the vacuum of research into using three-dimensional models, Chapter 9 tells a cautionary tale.

It would be too much to expect a book like this to engage with the geomorphological literature. For instance, it does not consider the way in which different river channel boundary conditions interact to control the nature and dimensionality of particular flows, and hence which assumptions can and cannot be made in choosing the most suitable model to use. A text that links CFD explicitly with fluvial geomorphology is still needed. However, this criticism is unfair, both because of the intended readership of the book, and because selectively dipping into the book will go some way to providing the basic minimum knowledge that any geomorphologist should have if they are hoping to engage in numerical modelling of shallow-water flows. It has its weaknesses and errors, but it is certainly the best basic text in this area that I have yet seen.

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AEOLIAN GEOMORPHOLOGY: AN INTRODUCTION by Ian Livingstone and Andrew Warren, Longman, Harlow, 1996. No. of pages: xi+211. Price: £25.99 (pb). ISBN 0-582-08704-X.

Over the past decade, the emerging intellectual maturity of aeolian geomorphology has spawned a rash of research monographs, special volumes and thematic texts that have documented recent advances within the subdiscipline, and stimulated further interaction between researchers from many contributing disciplines. In contrast to these volumes, in this book Ian Livingstone and Andrew Warren attempt to synthesize both the progress and future challenges of aeolian geomorphology in a form and style appropriate for non-specialists and undergraduates. The result is a refreshingly lucid, timely and concise contribution which makes contemporary understanding of the work of wind on the landscape readily accessible to a wider audience.

The distinctive features of this book are its appealingly clear explanations, attractive layout, integration of coastal and arid-zone aeolian phenomena, and excellent

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amalgamation of the wealth of recently published research. Most chapters are well illustrated, and all conclude with a clear summary and a brief guide to further reading. The concise style of the book is established in the introductory chapter which considers, in just seven pages, the work of the wind and global wind patterns. Chapter 2 leads the reader gently through an account of the mechanics of grain motion in air. This is a neat summary which manages skilfully to blend the developments of the past three years or so with the established physical principles of the processes involved. Unfortunately, a number of errors erode the authority of this chapter somewhat. For example, the sand trap shown in Figure 2.9(a) is not, as stated, a ''Leatherman trap'', and the transport history depicted in Figure 2.10 is not from the wind tunnel measurements of Butterfield (1993) but from the numerical simulation model of McEwan (1991). Despite such errors, this is a very useful exposition of contemporary understanding.

The erosive work of wind is then given brief but significant recognition in the third chapter, before more substantial discussion of dust in Chapter 4. The latter deals with measurement, motion, sources and sinks of dust, and despite the succinct treatment, leaves the reader in no doubt regarding both the distinctiveness and importance of dust-related processes and landforms.

The considerable field experience of both authors is particularly evident in the treatments of aeolian dunes (Chapter 5) and sand seas, dunefields and sand sheets (Chapter 6). These chapters are both skilful syntheses of a now vast literature and, in many respects, form the core of the book. The geographical coverage is impressive and, in contrast to most previous texts, both desert and coastal dunes are discussed. This treatment ably demonstrates the complementarity of aeolian geomorphology with coastal, desert and arid-zone geomorphology, as well as the benefits of recent multi-disciplinary research.

Chapter 7 promises to introduce ''some key concepts about aeolian sand deposits'' (p. 112) but deals almost exclusively with the textural properties of dune sands and with our primitive knowledge of the sedimentary structure of aeolian dunes. This is little more than a stimulating if tantalizing glimpse of a beckoning research frontier. The final two chapters deal with palaeoenvironments and aspects of applied aeolian geomorphology. The latter sets the rest of the book in context by consideration of wind erosion of agricultural soils, control of dust and sand drifting, and the management of dunes in coastal and arid environments. The similarity of management problems in diverse aeolian environments is readily apparent from the final chapter, but the reader is reminded that any technological ''fixes'' are constrained by a cultural subtext.

Overall, this excellent book provides the reader with a concise yet thoroughly contemporary overview of the processes and landforms of the aeolian world at spatial scales ranging from individual grains to sand seas, and at temporal scales ranging from those of saltation cloud response to climatic change. Throughout, the authors' collective wealth of field experience gives the book a commendable authority, and they have skilfully integrated both new and established ideas by judicious utilization of an extensive bibliography. The glossary of terms is a particularly welcome additional element.

Accessible texts at undergraduate level abound in other branches of geomorphology, but this is one of few such texts on aeolian geomorphology; consequently, it fills an obvious niche in the market. It is a well written, easily understood and highly informative book which makes a significant contribution to the continuing growth of aeolian geomorphology. Undergraduate students will find it an invaluable introduction to the geomorphology of windy environments; academics and professionals with an interest in aeolian processes, forms or management will find it a useful ''state-of-the-art'' summary, as well as enjoyable to read. I will be surprised if this book does not become the principal teaching resource for courses, or parts of courses, dealing with aeolian geomorphology at the undergraduate level.

References

Butterfield G. R. 1993. 'Sand transport response to fluctuating wind velocity', in Clifford, N. J., French, J. R. and Hardisty, J. (Eds), *Turbulence: Perspectives on Flow and Sediment Transport*, John Wiley and Sons, Chichester, 305–335.

McEwan, I. K. 1991. *The Physics of Sand Transport by Wind*, unpublished PhD thesis, University of Aberdeen, 121 pp.

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GLACIAL GEOLOGY: ICE SHEETS AND LANDFORMS by Matthew R. Bennett and Neil F. Glasser, John Wiley and Sons Ltd, Chichester, 1996. No. of pages: x+364. Price: £19.99 (pb). ISBN 0-471-963445-3.

According to the authors, this book is the product of two things: an enthusiasm for glacial geology, and a perceived need for a student text to stimulate this enthusiasm in others. Thus, it aims to provide an accessible account of glacial geology, uncluttered by unnecessary detail. In this, I feel it generally succeeds. The book uses a simple, logical chapter sequence, which progresses through a brief review of the history of ice on Earth, into two chapters which provide a simple account of mass balance and ice flow, and then the production of, and role played by, glacial meltwater. These chapters are followed by two reviewing processes of glacial erosion and the resulting landforms, and five covering the processes of glacial transport, glacial sedimentation on land and the resulting landforms, and glacial sedimentation in water and the resulting landforms. It concludes with a chapter introducing the interpretation of glacial landscapes. Each chapter consists of a 'core' introducing the material under consideration, and a series of 'boxes' which provide more detailed illustrations of the subject, taken from papers in the

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